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Influence of Uncertainty in Financial Markets on Import and Consumption

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Abstract

Objectives: This study has analyzed the influence of changes in financial market in Korea on the import and consumption as an object economic index. **Methods/Statistical Analysis**: Financial market has measured the historical changes on bond, foreign currency and stock market. On the other hand, import and consumption were calculated by using the changes in log value from final consumption of households and import amount of each service and goods. **Findings**: According to the result of analyzing the causal relationship by using the Granger causality test, volatility in financial market turned out to significantly influence on the import and consumption. As for bond market, a result has been derived that there was an opposite influence. As for impulse response function based on VAR model, it represents the influence of volatility in financial market on import and consumption in dynamic manner. In addition, variance decomposition of forecast error compares the relative explanatory power of volatility in financial market that accounts for distribution of import and consumption. **Improvements/Applications**: As for Korea, volatility in financial market turned out to be negative in import and consumption. According to the result of variance decomposition of forecast error, volatility in foreign currency market turned out to have the highest level of explanatory power on import and consumption.

Keywords: Consumption, Granger Causality Test, Import, VAR, Volatility in Financial Market

1. Introduction

The case of sub-prime mortgage in America in 2008 has caused the global recession in object-economy. Viewed in this light, it is of a global financial crisis. At that time, recession in housing market in America has caused the global depression in object-economy through international financial market that was strongly connected with them. Growth in financial industry not only positively influenced on economic growth but also caused unexpected and negative impact such as global financial crisis. Financial arbitration function tends to be well operated in connection with savers and investors once the financial development is developed[1-3]. Therefore, they emphasized how efficiency of resource distribution was to be improved by reducing the imbalance of information. However, according to the study by[4,5], it was alerted that the role of financial market has been overly emphasized in the course of economic growth. According to the previous studies in dealing with opposing insistences, this study aims to practically analyze the relationship between financial market and object economy. Korea has laid foundation for economic growth through export-driven policy led by the government in the 1970s and 1980s.

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Employment was increased in the field of exportation industry from an increased exportation, and this effect has led to the increase of import and consumption as a part of virtuous cycle. During this period, Korea was able to accomplish high level of growth through virtuous cycle in the domestic demand and exportation. However, in spite of success in exportation unlike the past in Korea, there have been issues regarding recession in consumption market and decrease in employment. Due to an increase of proportion of imported resources and relative decrease in exportation in small and medium companies, virtuous cycle between exportation and domestic demand has been deteriorated. However, in spite of such changes in economic structure, trade has still been an important economic variable in Korea. Korea has continuously recorded surplus in current account after the IMF foreign currency crisis in 1997. Furthermore, at the time of global financial crisis in 2008, Korea was the only country that did not record negative GDP growth rate per head among OECD (Organization for Economic Cooperation and Development) countries. Seeing as how the level of trade openness was high in Korea, it might seem to be a paradoxical result. However, China as the primary country for the trade with Korea has achieved almost as high as 10% of economic growth rate during the period of global financial crisis. Therefore, the amount of export has not been significantly reduced. However, in spite of success in exportation in Korea, decrease in domestic demand has recently been an important economic issue. Recession in domestic demand might directly damage on the sales of small and medium companies that mostly target domestic markets. Seen in this perspective, it is of a serious issue. This study has dynamically analyzed the influence of uncertainty in financial market from the case of global financial crisis on the import and consumption of one particular country by using time series resources. Due to high trade openness in Korea, import and consumption are closely related. In addition, since financial market opened due to capital liberalization in the 1990s, Korea is an appropriate subject for practical research.

In this study, bond market, foreign currency market, and stock market were selected to analyze the relationship between financial market and object-economy. Following have organized previous studies in dealing with relationship between each of the financial markets and object-economy variables. First of all, most of the previous studies in dealing with the relationship between variability and trade in financial market have focused on uncertainty in foreign currency market[6-8]. In general, if the variability is expanded, the risk of transaction from trade might also increase. Therefore, uncertainty in foreign currency market serves as a role of reducing the trade. In has derived the result from the research that uncertainty in foreign currency market negatively influenced on the export. In[9] has derived the result that there was a significant relationship between uncertainty and trade from foreign currency market in five developed countries; America, England, Germany, France, and Japan. On the other hand,[10] has practically analyzed the relationship between uncertainty in currency exchange rate and exportation by dividing into developed and developing countries. Uncertainty in currency exchange rate turned out to significantly influence on developing countries but vice versa on developed countries.

Studies by[11-14] have focused on the bond market among financial markets and analyzed the relationship with object-economy. In insisted that the difference between short-term and long-term interest played an important role when predicting the growth rate of private consumption in America. In have derived a result that short-term and long-term interest spread was useful in predicting object-economy variables including GDP growth rate, consumption, and investment. Furthermore, in[14] have mentioned the importance of fiscal policy on America and Europe while deriving the result that short-term and long-term interest spread was useful in significantly predicting the object-economy variables and inflation. Other than them,[15,16] have emphasized the importance of stock market when predicting the object-economy. In has insisted that the stock price decreased due to low expectation on the dividend of companies in the future when investors predicted the recession by using dividend discount model, and stock indices could be an important index in predicting the object economy. Multi-variable vector auto regressive model and grander causality verification were used by[16] in the study. According to his study, it was derived that there was a significant relationship between stock profit rate and object economy variables

in America. According to aforementioned results, uncertainty in financial market turned out to overall negatively influence on object economy. This study has practically analyzed how uncertainty in financial market in Korea with a high level of trade openness influenced on import and consumption. Especially, additional work has been added comparing explanatory power in each of the financial markets on the import and consumption while suggesting the differentiated results and contributing to the related literature review as an objective of the research.

2. Proposed Work

In this study, stock, bond, and foreign currency market were selected as surrogate variables in order to measure the volatility in financial market while using the stock price, interest rate, and currency exchange rate in each of the markets. To be specific, stock price was measured KOSPI, while interest was measured with currency exchange rate according to the closing price from Won/dollar exchange rate and CD (91 days) interest rate. Import was measured by using import of goods and services, while consumption was estimated by using household final consumption expenditure. However, comparing how import and consumption were observed in monthly data and quarterly data, respectively, variables in the financial market were provided in daily data. Therefore, monthly standard deviation in the daily increasing rate from variables in the financial market was used while measuring volatility as follows instead of using ARCH type model in order to utilize information of variables in financial market as much as possible.

$$\sigma_t = \sqrt{\frac{1}{n_t - 1}\sum_{i=1}^{n_t}(r_{ti} - \bar{r_t})^2}$$

(n_t is the number of daily data in the month t, and $\bar{r_t}$ is the average daily increasing rate in the month t)

On the other hand, import has been calculated in the following equation as monthly data were published. IMR_t indicates the import changing rate in the period t, and was derived in log calculation.

$$IMR_t = ln\left(\frac{Import_t}{Import_{t-1}}\right) \times 100$$

This study has used time series data from January, 2001, to June, 2015. Variables in financial market, import amount, and final consumer expenditure in household were collected from economic statistical system in the Bank of Korea. First of all, among volatility in financial market derived from aforementioned market, KOSPI turned out to have the highest volatility. Especially, due to the aftereffect of global financial crisis diffused as of the application of bankruptcy protection from Lehman Brothers, variability turned out to be highest in the last half of 2008. On the other hand, interest and currency exchange rate turned out to have a higher level of variability after the mid-2009. According to such volatility, the volatility of currency exchange rate turned out to be very stable except for the period of global financial crisis. However, interest rate and stock price index turned out to have a wider range of variability, and the difference turned out to be higher in the stock price. On the other hand, household final consumption expenditure tended to represents a similar trend. During the period of analysis, import and consumption turned out to be temporarily decreased due to the influence of global financial crisis in 2008. However, there has been overall an increasing trend on it. In order to clarify the specific relationship among import, consumption, and volatility in the financial market in this study, various methodologies were used. First of all, causality test[17] was performed to verify the causal relationship between two variables. It was to identify whether volatility in financial market influenced on import and consumption through causal relationship verification and also whether there was an opposite influence. Secondly, unit root test was performed for VAR model[18]. In order to derive more detailed values and graphs, generalized impulse response function and variance decomposition of forecast error were used based on the VAR model. Generalized impulse response function dynamically represents how import and consumption are changed due to impulse in volatility in financial market. Variance decomposition of forecast error compares the relative influence of volatility in financial market for explaining the import

and consumption. Seen in this context, they are very useful methods.

2.1 Effect of Volatility in Financial Market on Import

Prior to using VAR model, it is required to confirm the stationary of time series variables. Following Table 1 represents the result of unit root test of import increasing rate and volatility in individual financial market that used monthly data. As for unit root test methods, ADF (Augmented Dickey-Fuller) test and P-P (Phillips-Perron) test were used. According to the result of unit root test, null hypothesis that there were unit roots in all the variables in the 10% of significance level was dismissed. Therefore, it turned out the stationary time series courses were followed. In this study, it has been analyzed whether there was a causal relationship between two variables through Granger causality test for more detailed dynamic causal relationship between volatility in financial market and import. Table 2 represents the result of causal relationship between volatility in financial market and import. Null hypothesis was that there was no Granger causal relationship. If dismissing it, significant causal relationship was regarded to exist. In this study, ripple effect between financial market and object economy has been analyzed in the maximum interval of six months. According to the Table 2, volatility in financial market used in this study turned out to significantly influence on all the import increasing rates, and such an effect was confirmed to last for relatively med-long term for more than six months. Especially, volatility in foreign currency market and stock market turned out not to be influenced by the import. However, there were multi-directional causal relationships between volatility in bond market and import. In other words, volatility in bond market turned out to be influenced by the import increasing rate unlike foreign currency and stock market. According to the result of causality test, VAR model was used to additionally derive the generalized impulse response function between the volatility in financial market and import increasing rate. In the VAR model, volatility in financial market and import increasing rate were set as endogenous variables. In addition, GNI was considered as an exogenous variable. The import scale was influenced by the determination of consumption on imported goods, and consumption was to be expressed in import function. Therefore, GNI that influenced on the importation was set as an exogenous variable for the model of fit. Results of impulse response function based on VAR model are shown in the Figure 1. According to Figure 1, individual variables turned out to be influenced the most by impulse of them occurring in the previous term. The first column represents the response of each variable in the bond market. The second and third columns represent response of each variable in the foreign currency market and stock market. Volatility in the bond market turned out to be positively influenced by the variability in other financial markets. However, impulse of import increasing rate turned out to reduce volatility in bond market. According to the result of generalized impulse response function among volatilities in the financial market, the highest correlation was derived between foreign currency market and stock market. Impulse of volatility in the foreign currency market turned out to expand the variability in stock market, and the same result was derived in the vice versa. The last and the fourth column in Figure 1 represents the relationship between volatility in each financial market and import. The impulse of volatility in foreign currency market and stock market turned out to negatively influence on the import increasing rate. However, if the volatility in bond market was expanded, import increasing rate was increased and decreased repetitively and hence was irregularly influenced by them. Results in the generalized impulse response function have an advantage for comparing the relative importance of variability in individual financial markets on the import increasing rate by using the variance decomposition on the forecast error between financial markets besides the result of import and volatility in the financial market. In the following Table 3, variance of import increasing rate was explained by them and volatility in the financial market. Import increasing rates turned out to be explained for more than 80% by them. When comparing with the part explained by volatility in financial market, it turned out to be in an order of foreign currency market, bond market, and stock market. Especially, volatility in foreign currency market only turned out to record two digits of import increasing rate and hence to be the most closely related with import increasing rate among financial mar-

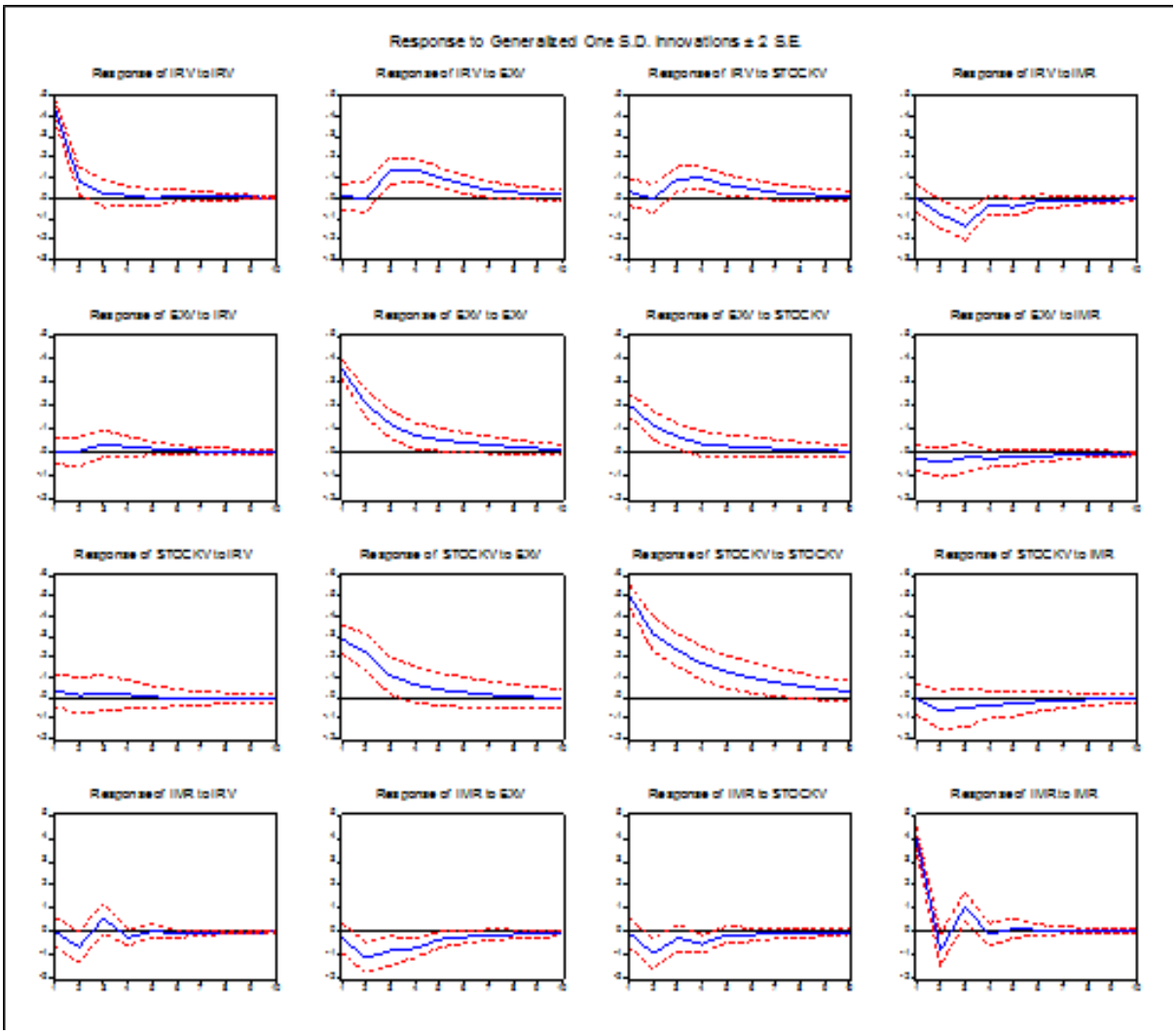

Figure 1. Result of impulse response functions of volatility in financial market and import increasing rate.

Table 1. Result of unit root test (monthly data)

Test method	Interest rate volatility	Currency exchange volatility	Stock price volatility	Import increasing rate
ADF test	0.000 (-8.590)	0.041 (-3.514)	0.018 (-3.811)	0.000 (-5.201)
P-P test	0.000 (-8.551)	0.000 (-6.206)	0.000 (-6.686)	0.000 (-14.935)

Notes: ADF(Augmented Dickey-Fuller) test was performed according to AIC (Akaike Information Criterion). P-P test indicates Phillips-Perron test. The value in this table is P-value, and the value in the parenthesis is the t-value.

Table 2. Result of Granger causality test between financial market and import

Null hypothesis	Lag(1)	Lag(2)	Lag(3)	Lag(4)	Lag(5)	Lag(6)
Interest ≠> *l* mport Import ≠> Interest	10.422*** 8.144***	4.032** 15.855***	2.480* 10.815***	2.767** 8.266***	2.338** 6.822***	2.728** 5.715***
Ex rate ≠>Import Import ≠> Ex rate	35.739*** 1.478	14.066*** 0.714	10.041*** 1.540	8.858*** 1.274	8.385*** 1.006	7.160*** 1.274
Stock ≠> Import Import ≠> Stock	14.302*** 0.950	5.403*** 0.336	3.989*** 2.621*	5.078*** 1.717	5.042*** 1.907*	4.304*** 1.449

Notes: Value suggested in the table is F-value, and *, **, *** indicate 10%, 5%, and 1% significance levels for dismissing the null hypothesis for how there is no Granger causality relationship.

Table 3. Result of variance decomposition of forecast error on the import increasing rate

Period	Interest rate volatility	Currency exchange volatility	Stock volatility	import
1	0.000	0.465	0.118	99.417
2	2.338	6.948	0.593	90.121
3	3.669	9.517	0.710	86.104
4	3.875	11.593	0.759	83.773
5	3.856	12.028	0.792	83.324
6	3.885	12.225	0.790	83.101
7	3.888	12.313	0.793	83.006
8	3.888	12.362	0.794	82.955
9	3.889	12.394	0.795	82.923
10	3.889	12.410	0.795	82.906

kets. In addition, bond market turned out to have a higher explanatory power than stock market. Such results represent that influence on object economy might not always be proportionate with the size of variability when considering how volatility is generally high in stock market among volatilities in financial market.

2.2 Effect of Volatility in Financial Market on Consumption

In order to practically analyze the relationship between volatility in financial market and consumption increasing rate, quarterly data of each variable were collected. Consumption was measured by the final household consumption expenditure, and actual variables adjusted with season were used in consideration of characteristics of quarterly data. According to the following Table 4, all the variables turned out not to have unit root when testing the unit root by using quarterly data. Therefore, they seem to be stable in time series. According to the result of causality test, variability in the bond market in the first quarter and consumption increasing rate turned out to have bi-directional causal relationships. However, only the volatility in bond market turned out to influence on

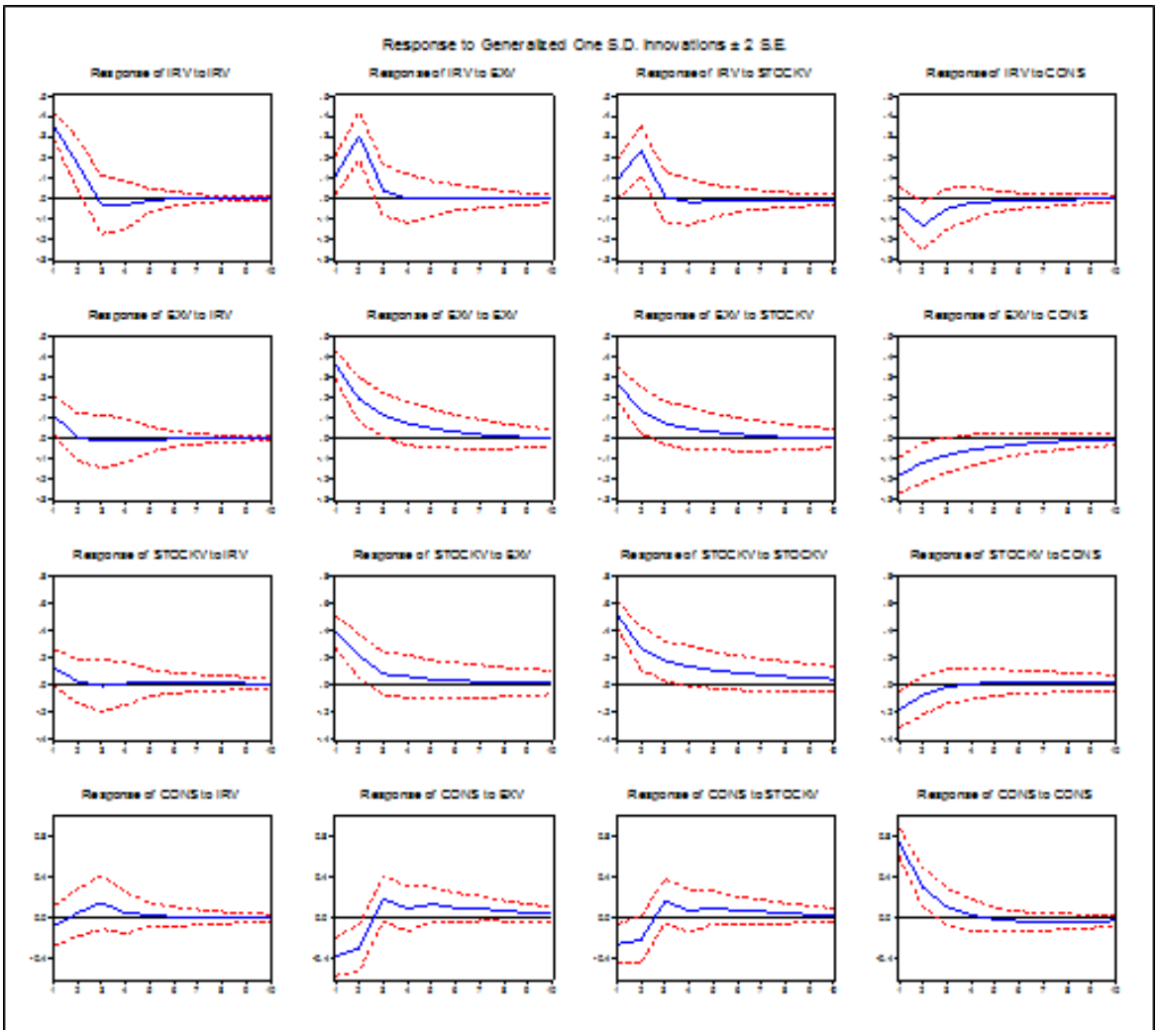

Figure 2. Result of impulse response functions of volatility in financial market and consumption changing rate.

Table 4. Result of unit root test (quarterly data)

Test method	Interest rate volatility	Currency exchange volatility	Stock price volatility	Consumption changing rate
ADF test	0.000 (-5.043)	0.024 (-3.796)	0.003 (-4.527)	0.000 (-5.064)
P-P test	0.000 (-5.002)	0.024 (-3.796)	0.003 (-4.526)	0.000 (-5.123)

Notes: ADF(Augmented Dickey-Fuller) test was performed according to AIC (Akaike Information Criterion). P-P test indicates Phillips-Perron test. The value in this table is P-value, and the value in the parenthesis is the t-value.

Table 5. Result of variance decomposition of forecast error on the consumption changing rate

Period	Interest rate volatility	Currency exchange volatility	Stock volatility	Consumption changing rate
1	1.147	24.604	0.223	74.026
2	1.297	35.189	0.180	63.334
3	4.110	33.542	0.278	62.070
4	4.300	33.678	0.273	61.750
5	4.304	34.888	0.265	60.543
6	4.263	35.641	0.266	59.830
7	4.227	36.308	0.268	59.198
8	4.201	36.700	0.271	58.828
9	4.185	36.935	0.275	58.605
10	4.177	37.055	0.279	58.489

consumption increasing rate from the second quarter and the effect lasted for a year and disappeared. However, no significant causal relationship between volatility in stock and foreign currency market was found in the first quarter. However, it turned out to be a cause for significant impulse on the consumption increasing rate from the second quarter. Dynamic correlation in the volatility in the financial market and also between variability in the financial market and consumption increasing rate has been derived with generalized impulse response function in the use of VAR model. When setting the VAR model, variables related to volatility in the financial market and consumption increasing rate were established as endogenous variables, while GNI increasing rate was considered as an exogenous variable for well explaining the consumption increasing rate. According to Figure 2, there was a significant influence among variabilities in the financial market in the same manner with results of monthly data. To be specific, if the variability in each financial market is expanded, volatility in other financial markets is also influenced to be increased. On the other hand, according to the result of generalized impulse response function between variability in the financial market and consumption increasing rate, variability in the financial market turned out to mostly negatively influence on the consumption increasing rate. Especially, expanded volatility in foreign currency market and stock market turned out to clearly reduce consumption increasing rate. In addition, variability in bond market turned out not to significantly influence on the consumption increasing rate. Results of the variance decomposition of forecast error on the variance in consumption increasing rate is shown in the Table 5. Variance in consumption increasing rate turned out to be explained the most by it. About 60% of variance was explained by itself. As for variability in the financial market, currency exchange rate variability turned out to be the highest as about 35% followed by 4% in interest variability and less than 1% in stock variability. These results indicate that volatility in foreign currency market was what explained the consumption increasing rate the most among volatilities in the financial market.

3. Conclusion

This study has practically analyzed the effect of volatility in the financial market on import and consumption by using monthly and quarterly data. In order to analyze dynamic correlation among variables, Granger causality relationship test, impulse response function based on VAR model, and variance decomposition of forecast error methodologies were used, and the period of analysis was from January, 2001 (1st quarter) to June, 2015 (second quarter). Results of the analysis are briefly summarized as follows. First of all, according to the result of testing the causal relationship among volatility in each of the financial markets, import, and consumption, volatility in the financial market turned out to significantly influence on the import and consumption increasing rate in med-long term. However, volatility in the financial market turned out to influence on object economy in foreign currency market and stock market. However, volatility in bond market turned out to have an opposite direction of causal relationship. Secondly, according to the result of deriving the impulse response function through VAR model, it was confirmed that there was a close relationship among financial markets in Korea. Therefore, impulse occurring in one particular financial market turned out to enhance uncertainty in other financial markets. This means that the ripple effect shall be considered in other financial markets other than influence on the relevant market when performing the financial policies such as fiscal policy. Third, according to the graph of impulse response function, if volatility in foreign currency market and stock market was expanded, it caused negative influence on import and consumption. This means that variables related to financial market played as an important role in decision making on consumers. Therefore, it is required to make an effort to resolve uncertainty in financial market to improve domestic demands and improve the economy. Fourth, foreign currency market turned out to be the financial market that represented the highest level of explanatory power among variance of import and consumption increasing rates through variance decomposition of forecast error. In Korea, bond market and stock market were able to achieve quantitative growth as financial market was developed. However, due to high level of trade openness, volatility in foreign currency market turned out to have the highest level of explanatory power. Therefore, it is required to focus on dealing with the role of foreign currency market in the decision making process for policies in improving domestic demands. This study is meaningful in that it practically analyzed

the influence of uncertainty in financial markets on the import and consumption when virtuous cycle of exportation and domestic demand has recently been deteriorated. However, there are still limitations of this study. First of all, only one observed value was selected and used in each of the financial markets as a surrogate variable to measure volatility in financial markets. In order to accurately measure uncertainty in financial market, it is required to use more variables. Secondly, since final household consumption expenditure is provided in each quarter, there might not be many observed values if setting the period for analysis after 2001. However, if expanding the period to before 2001 for analysis, new issues might occur with influence from IMF foreign currency crisis.

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